Integrated Library Systems

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ABSTRACT

The development of integrated library systems is discussed. The four major discussion points are (1) initial efforts; (2) network resources; (3) minicomputer-based systems; and (4) beyond library automation. Four existing systems are cited as examples of current systems.

THE HISTORY of integrated library systems is the history of library automation itself. The earliest efforts were concerned not with the computerization of individual functions, such as circulation, but with a totally integrated system to be achieved in a modular fashion. It is enlightening to consider the stages of development that have led from the earliest systems development until the present time: (1) initial efforts—the promise of integrated systems; (2) network resources; (3) minicomputer-based systems; and (4) beyond library automation.

INITIAL EFFORTS: THE PROMISE OF INTEGRATED SYSTEMS

One of the earliest systematic efforts in library automation began at the University of Chicago in 1965, when Dr. Herman H. Fussler, director of the University of Chicago Library, submitted a proposal to the National Science Foundation to develop an integrated, computer-based bibliographic data system. The general objectives of the proposed system were as follow [1]:

1. Improve substantially the response time of libraries in almost all of their routines.
2. To extend the scope and quality of library service to readers at small incremental cost.
3. To assemble library performance data.
4. To stabilize and hopefully reduce, the unit costs of many library routines that, under traditional manual procedures, tend to rise with labor costs.
5. To provide basic library record systems that would be capable of relatively easy change and alteration to meet changing needs or concepts in the intellectual organization or content analysis of library resources, and location of books and other materials within the system.
6. To provide data systems that would be easily capable of handling existing levels of bibliographical analysis and descriptions, and yet be adaptable to more sophisticated levels.
7. To provide systems that can take full advantage of machine-readable bibliographic data generated by other agencies such as the AEC, NASA, and National Library of Medicine, the Library of Congress, etc.
8. To provide systems in both hardware and software that are capable at reasonable cost, of adjusting to long-term growth.

Even though an on-line catalog was not mentioned as part of the objectives, Dr. Fussler went on to state the following [2]:

> . . . it is intended to use this highly integrated system, ultimately, to handle readers' requests for material or catalog searches, and to provide almost instant information on availability and location; to prepare specialized bibliographies, or to supply current awareness references, to handle want lists, recall, or holds for readers. It will be used to speed up almost all processing operations by handling such routines as searches prior to ordering; to prepare book and serial purchase orders, catalog cards ready for filing, selective book catalogs where indicated, manual or machine-readable circulation cards, accession lists, bindery tickets, call number labels, book pockets; to handle book fund accounting, dealer claims, etc.; to generate performance data on book use, book availability, dealer performance, staff processing performance, and other operational matters.

Dr. Fussler and his staff were obviously not alone in considering the application of computers to library operations, but they did lay the foundation upon which other edifices have been, and are still being, built. The objectives and goals, which they clearly enunciated so many years ago, are still valid today.

In July 1966, the University of Chicago Library received an initial grant of $118,000 from the National Science Foundation to begin what was to be a three-year program. A bibliographic data processing system became operational at the University of Chicago in 1968. Then, in the early 1970s, effort was undertaken to design a second-generation system that incorporated the experience obtained in the earlier efforts as well as new advances in computer technology. Central to this new design was the concept of a single master bibliographic file [2].

Other early large-scale system efforts included Stanford University's Bibliographic Automation of Large Library Operations using Time Sharing (BALLOTS), the Washington Library Network System (WLN), Northwestern University's NOTIS, and IBM's Dortmunder Bibliotheks System (DOBIS) [3–6]. The work at Stanford became the basis for the more recent development of the Research Library Information Network (RLIN). The WLN system is based in part on the conceptual design laid down by the University of Chicago, and was implemented from the perspective of a state-wide library network to serve both public and academic libraries.

Although considerable progress was made, total integration proved to be more difficult and costly than originally thought. These large systems did not achieve total integration of library functions in the 1970s. Furthermore, their cost precluded consideration of these systems by most libraries.

Network Resources

During the same period in which the aforementioned library systems were being developed, two events occurred that had, undoubtedly, the greatest effect on the automation of local library functions in the 1970s—the establishment of OCLC in 1967, followed by the adoption of the MARC II format and distribution service at the Library of Congress in 1968. These two events gave libraries a viable alternative to local automation. This alternative, access to networked resources, allowed the cost of automation to be shared by many. The shared cataloging activity of OCLC was to be, in fact, the first part of an integrated system [7]:

> The entire system, including shared catalog, bibliographic information retrieval, circulation control, serials control, and technical processing, will be based on one file, thereby achieving a truly comprehensive system.

For a time, it appeared as if the network resources would eventually serve all the needs of small and medium-sized libraries and obviate the need for local automation. Indeed, for many libraries the shared network resources of OCLC, RLG, SOLINET, UTLAS, etc., have served the needs of cataloging, serials control, acquisitions, and interlibrary loan. The same swing of the pendulum that has occurred in all computer applications—from local to centralized (network accessible) to distributed processing—was to be reflected in library applications as well. In a 1976 article, DeGennaro [8] summed up the situation of library automation and foretold the very developments that are the subject of this symposium:

> During the years under review we have seen the main thrust of library automation evolve from building total or integrated systems for individual libraries using local systems staffs and equipment, to building regional library networks using the systems, facilities, and staffs of a few major centers such as the Library of Congress, New York Public Library, OCLC, Chicago, and Stanford. We have also seen the parallel emergence of a new concept at Minnesota, namely the development of a powerful, flexible, and inexpensive minicomputer system for use in a single library. If this concept proves itself it could combine some of the best features of the total systems goal of the 1960s with the major success of the 1970s—the cooperative network. This marriage could produce what may become the dominant thrust of the 1980s—the development of cost-effective in-house library minicomputer processing and catalog access systems capable of interfacing synergistically with an effective national library network for sharing bibliographic data and library resources.

Minicomputer-Based Systems

In light of the difficulties encountered in achieving total integration in large-scale systems, it was not surprising that the earliest applications of minicomputers in libraries were to automate single functions, particularly circulation [9–11]. Another salient minicomputer application was the development of the serials control and shared-serials holding system, PHILSOM, at Washington University School of Medicine Library, St. Louis (see following article by Susan Crawford).

The development at Minnesota to which DeGennaro referred was, of course, the Minnesota Integrated Library System (MILS), initiated at the University of Minnesota Biomedical Library in 1972 with a grant from the National Library of Medicine (NLM) [12]. This pioneering effort had, however, a major technical drawback. MILS, initiated before many of the advanced minicomputer software support systems and higher-level languages had become available, was implemented in machine language specific to the equipment purchased. This resulted in a system that could be implemented by only one vendor's equipment (DEC, PDP11 minicomputers). It also required system-level data processing personnel for maintenance or changes.

Today, because of the advanced computer software systems, high-level languages, and network resources, the potential of achieving a local, minicomputer-based integrated library system is no longer debated. All of the major minicomputer-based library systems are moving inexorably toward a complete integration of functions. Although existing systems, including those discussed in this symposium, are at different stages of completion, there is no reason to doubt that they will soon achieve that goal. Now, the only question seems to be, "Can it also be done on a microcomputer?" Even this question is academic, as the microcomputers of today are more powerful than the minicomputers of yesterday. In fact, the four systems described herein could be implemented on the DEC PDP 11/23 and 11/24 microcomputers.

The four systems to be discussed have unique aspects as well as interesting similarities. The similarities appear to have been engendered by (1) universality of the problem; (2) common recognition of appropriate technologies; and (3) communication among those concerned with the design of each system.

All four systems have been implemented in versions of MUMPS. These include the Georgetown University Library Information System (LIS), the Washington University (St. Louis) BACS, the Jerusalem University MAIMOD, and the NLM Integrated Library System (ILS).* It is not unreasonable to ask at this point, "Why did all four libraries choose to use MUMPS?"† and, "What is MUMPS?" The answer to the first question seems to be a common recognition of appropriate technology that, in this case, is MUMPS. The answer to the second question is multifaceted. MUMPS is really three things: an operating system,‡ a data base management system, and an ANSII-standard computer language. MUMPS was originally an acronym for "Massachusetts General Hospital Utility Multiprogramming System." The development of MUMPS began in 1967, at the Massachusetts General Hospital's laboratory of computer science [13]. It was designed from the beginning for minicomputer-based on-line information applications dealing with storage, manipulation, and retrieval of nonnumeric, textual data bases, (e.g., on-line medical information systems). Although it has become an ANSII-standard computer language, its origins within the biomedical community account for its slow diffusion to other, more general applications. For those libraries with the ability to choose an appropriate system before choosing the appropriate computer, it is not surprising that MUMPS was the choice. It has unique capabilities for minicomputer-based on-line information systems.

Three of the four MUMPS systems—LIS, BACS, and MAIMOD—were implemented with minimal in-house staff; in each case, the local library staff provided the library system's requirements and one or two system designers/programmers effected the implementation. This approach proved, for the libraries involved, the most cost-effective path to library automation. It must be stressed, however, that this approach would not have been possible without the powerful, high-level capabilities of a system and language such as MUMPS.

The NLM ILS was designed and implemented as a demonstration project for biomedical libraries of all sizes. As a result, the emphasis in ILS has been on the development of tools, rather than on the formats and requirements of a particular library. It has also been a much larger effort.

Beyond Library Automation

The goals and objectives enunciated by the University of Chicago staff in 1965 have, since that time, been a de facto definition of what is meant by an integrated library system [2]. Thus, until today the pursuit of an integrated library system has been limited to the automation of functions traditionally performed in a library. However, libraries are being called on to provide new services and to encompass new functions that lie outside the scope of traditional library automation. Matheson and Cooper addressed the future of libraries in an academic health sciences center [14]. They called on libraries to embrace a broader mandate, to become not merely better libraries in the traditional sense, but to become academic health sciences information centers. The spectrum of information to be managed by these academic centers is very broad, including access to data bases outside the library, to library- and subject-specific bibliographic data bases, and to knowledge-based

*Integrated Library System and ILS are trademarks of the National Library of Medicine.

†MUMPS also forms the basis for the dataphase Data General minicomputer ALIS system.

‡The "operating system" is the name of that software that provides access to the basic capabilities (input, output, terminal interaction, etc.) of a computer. The name "operating system" distinguishes this software from the more familiar applications software. Operating systems are usually supplied by the hardware vendors and are usually unique to each vendor's equipment. MUMPS is an exception in that it was not developed by a hardware vendor and runs on many different vendors' equipment.

systems as originally addressed by Licklider [15]. They called on libraries to take an active role in serving the future information needs of health sciences professionals.

It is not clear that a consensus will ever be reached on what should be subsumed under the rubric "integrated library system." It is clear, however, that the concept of an integrated library system will broaden and change as new library functions are addressed. From this perspective, the systems discussed in this symposium are already moving beyond library automation. One example is network linkage, such as OCTANET at Washington University, St. Louis, which links libraries in the Midcontinental Region, and LIS at Georgetown University, accessed by twenty libraries. Other developments include patron access to a library-specific bibliographic data base (mini-MEDLINE with LIS), electronic mail (ILS), and accounting and office procedures (LIS).

Conclusion

As history has shown, the concept of an integrated library system preceded the technical ability to achieve it. Today, the technology is available to achieve what was originally sought, but the original goals no longer represent all of what is needed.

It is gratifying to note that some of the truly pioneering work in library automation occurred within the biomedical community: the minicomputer efforts at Minnesota under Glen Brudvig; the on-line serials check-in and control system at the University of California, Los Angeles, Biomedical Library under Louise Darling; and the PHILSOM-shared serials control system at Washington University, St. Louis, Medical Library under Estelle Brodman (see article by Susan Crawford) [16, 17]. Continuing in the same tradition, the systems addressed in this symposium are defining anew what is meant by the phrase "integrated library system." Much remains to be done, but no doubt remains as to what can be achieved.

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